

SUBJECT INDEX

A

Abundances

- in Crab Nebula, 83-84
- in Cygnus Loop, 84-89
- in fast-moving knots in Cas A, 76-77
- in irregular galaxies, 47-50
- in the outer planets, 301, 393-95
- in quasi-stationary flocculi in Cas A, 77
- solar, 298
- in the solar system, 301
- stellar, 10, 19-20, 298
- in supernova remnants, 76-91

Accretion

- in binary X-ray pulsars, 538, 543-52, 586
- effect on white dwarfs, 29-30
- in galaxies in clusters, 189-202
- in galaxies in groups, 454, 467
- in neutron stars, 540, 545-52, 568-75, 579, 582-86
- in the rapid burster, 582
- in solar nebula, 399, 401-5
- in SS 433, 526-27
- in X-ray burst sources, 540, 566-68

Accretion disk in SS 433, 509, 513, 519, 527-29

Accretion disks, 437, 477, 483, 486-94

- in neutron stars, 550-51, 567-68

in solar nebula, 397-99

thin, 486-88

tori, 488-96, 498, 501-3

- ion-supported, 492-94, 502
- radiation supported, 491-92, 501

structure of, 488-90

viscous, 398-99, 419, 421

Accretion flows, 476-81, 485-94

Accretion, spherical, 478-81

Active galactic nuclei, 313, 435, 437-38

- black hole models for, 471-506

continuum of, 497-98

evolution of, 500-2

formation of jets in, 494-97

X-ray spectrum of, 499-500

Alpha Carinae, 10

Alpha Centauri, 614

Alpha Orionis, 310

AM Herculis stars, 31

Am stars, 14

AO 0235+164, 499

Ap stars, 614

Aperture synthesis, 97-98, 104-

10, 112, 121-23

image restoration in, 105-9

CLEAN algorithm, 106-7,

112-14

Gerschberg-Saxton algo-

rithm, 107

maximum entropy method,

108-9

Apollo program, 38

Aquila X-1, 567

Ariel V, 522-23

Ariel VI, 523

Asteroids, 405

A 262, 456

A 401, 200, 202

A 801, 192

A 1060, 456

A 1132, 192

A 1146, 200

A 1228, 201

A 1357, 200-1, 456

A 1413, 196, 200

A 1656 (Coma), 187, 192, 200-

1, 206-8, 211, 213, 435,

456, 460-61, 466

A 1930, 200

A 2029, 188-89, 196-98

A 2147, 456, 466

A 2151 (Hercules), 193, 201,

207-8, 456, 466

A 2199, 193, 201

A 2218, 189, 196

A 2634, 193

A 2670, 192, 200, 202

A 0535+26, 551

B

B stars

color temperatures of, 4

interstellar reddening of, 4, 6

subluminous, 27-28

Big bang theory of Universe,

157-84

alternatives to, 157-84

Binary stars

masses of, 559-61

orbital elements of, 552-59

Binary systems, close, see SS

433

Binary systems, neutron stars in interacting, 537-92

Binary X-ray pulsars, see Pulsars, X-ray binary

Binary X-ray sources, 41

Black hole models for active galactic nuclei, 471-506

Black holes, 261, 263, 437, 529-30

accretion flows into, 476-81, 485-94

and General Relativity, 481-83

interaction with magnetic fields, 483-94

Kerr metric, 481-84, 488, 504

orbit around, 482-85

Blazars, 495, 499

Blue stellar objects, 21

Bremssstrahlung, 250, 256, 361-62, 366, 370, 373-74, 477-78, 480, 497-98

C

Callisto, 396

Cancer cluster of galaxies, 459

CAO 340-538, 200

Cassiopeia A, 76-79

Centaurus A, 337, 342, 347

Centaurus X-3, 547, 554, 559, 562-63

Centaurus X-4, 567

Cepheid variables in irregular galaxies, 58

Chi Cygni, 310

Circinus X-1, 531

Cl 0016+16, 213-14, 218

Cl 0024+1654, 213, 216-18

Cl 1446+2619, 216, 218

Coma cluster of galaxies, 187, 192, 200-1, 205-8, 211, 213, 435, 456, 460-61, 466

Comets, 20

Compact ultraluminous sources, 473-75

Compton scattering, 372-73

Comptonization, 34, 474-78,

480, 497-98

Corona, solar, see Solar corona

COS-B, 440

Cosmic microwave background radiation, 157, 161-64, 170, 174, 177-80

Cosmic rays, 19, 34

galactic, 439-40

Forbush decreases of, 284
modulation of, 284

Cosmic rays, solar, 359

Cosmic rays, ultra-high-energy, 425-44
acceleration mechanisms for, 425-26, 432-38
anisotropy of, 430-32, 440-41
arrival directions of, 426-27, 431-32, 439
composition of, 429
electrical generators of, 433, 436-38
energy spectrum of, 425, 428-29, 433, 435-36
Fermi acceleration of, 433-36, 438
"leakage" of, 425, 429-31
shock-wave acceleration of, 433, 435-36
sources of, 426-32, 435-41
Cosmological constant, 162-64, 166

Cosmology, 9, 157-85
quantum, 169

Cowling approximation, 600

Crab nebula, 83-84, 432
pulsar in, 436-38, 537

CTB 80, 90

Cyclotron radiation, 543-47

Cygnus A, 499

Cygnus Loop, 84-89

Cygnus X-1, 500

Cygnus X-3, 432, 437, 441, 530

D

DA 240, 342

Doppler effect, 552

Doppler-shifted lines, 507-16

30 Doradus, 51, 263

E

Earth, solar neutron flux at the, 376

Einstein Observatory Satellite, 77-82, 85, 90, 337-38, 342, 522-23

Ergosphere, 482

Extragalactic radio jets, see Jets, extragalactic radio

F

F stars, supergiant, 312

Fabry-lens photometer, 8-9

Fermi acceleration, 433-36, 438

Fourier component, 97, 99, 105

Fourier tachometer, 601

Fourier transform, 99, 103-4, 106-7, 111, 124

Fourier transform spectroscopy, 291-317
of BN source in Orion
Molecular Cloud, 304-6
of galactic nuclei, 312-14
of gaseous nebulae, 309
instrumental flexibility of, 296
in mass-loss studies, 309-12
of molecular clouds, 304-7
multiplexing character of, 296
photometric accuracy of, 295-96
signal-to-noise ratio in, 293-97
of solar system, 300-3
spectral quality of, 294-95
of Sun, 297-99
throughput of, 293

Fourier inversion, 106

G

G stars, metal-poor subdwarf, 20

Galactic center, 223-65. See also Sagittarius A
defined, 245, 263
dust ring of, 246-54
far-infrared observations of, 246-49, 312

Fourier transform spectroscopy, 312-13

gamma-ray source in, 260-61

H₂ distribution in, 248-52

H I in, 242

H II regions in, 250-53, 255-56

infrared emission from, 246-54, 261-62

ionized gas in, 250-58

mass-loss from, 256-58, 262

radio emission from, 250-57, 261-62

stellar distribution in, 245-46, 249

Galactic clusters, 5

Galactic dynamics, 241-49, 263

Galactic nebulae, 309

Galactic nuclei, 223, 312-14, 437-38. See also Galactic center

Galaxies
evolution of, 185-222, 446-70
gas content of, 445-70
morphological classification of, 202-4, 445-46, 448-49, 454, 461, 465
morphological types of, evolution of different, 202-12, 446
red shifts in, 9, 157, 165, 216
shock waves in, 436

star formation in, 186-87, 194, 205-7, 211, 217, 446, 454, 464-65
X-ray emission in, 192, 450-51, 464, 466

Galaxies, cD
classification of, 188-89
colors of, 193-94
formation and evolution of, 188-96
merger process of, 189-92, 194-98
multiple nuclei of, 189, 196-97

Galaxies, clusters of, 185-222
cannibalism in, 196-98
cD galaxies in, 187-94
elliptical galaxies in, 185, 187, 193-95, 197-98, 200-2, 446
evolution of galaxies in, 185-222
luminosity functions of, 198-201, 207-8
particle acceleration in, 435
populations of, 186-87
red shifts of, 214-16
tidal stripping in, 189-202, 208, 461-63, 465, 467

Galaxies in clusters
accretion in, 189-202
colors of, 213-18
colors of H I-poor, 465-66
evolution of, 185-222
H I content of, 455-67
H I deficiency in, 455-61, 465, 467-68
initial conditions in formation of, 210-12
luminosity functions of, 206-7
mergers of, 189-202, 208-10
tidal stripping of, 189-202, 208, 461-63, 465, 467

X-ray emission from, 191-92

Galaxies, elliptical
in clusters, 185, 187, 193-95, 197-98, 200-2, 446
description of, 203
evolution of, 206-10
in groups, 454

Galaxies in groups, tidal streaming between, 450-54, 467

Galaxies, groups of, 450-54, 467
accretion in, 454

Galaxies, irregular, 37-74
abundances in, 47-50
clumpy, 39, 44-45, 65
colors of, 40-42, 49-50
dwarf, 39-41, 46, 50-51, 59, 66-67
low-surface-brightness, 39, 41, 47, 51, 59, 62-63

dwarf "blue compact," 39, 44, 47, 50
 evolution of, 37-74
 evolutionary status of, 65-67
H I content of, 44-46
 high-surface-brightness, 41, 47, 51-52, 57
 infrared observations of, 42
Initial Mass Function in, 41, 51-52, 54, 58-60, 62
 interstellar medium in, 38, 45-46, 49, 57-58, 64
Ir II or I0 systems, 38-39, 454
 kinematics of, 42-46, 57
 luminosities of, 39-42
 Magellanic systems (Ir I, Im), 38-67
 masses of, 43-46, 50
 star formation in, 38-67
 bursts of, 61-63, 65
 distribution of regions of, 55-56
 histories of, 58, 60-64
 and interstellar medium, 56-58
 rates of, 53-55, 60-61
 stochastic self-propagation model of (SSPM), 63-64, 66
 stellar populations of, 50-53
 UV observations of, 41-42, 51, 53, 57
X-ray observations of, 41
Galaxies, spiral, 39, 41, 44-45, 57
 in clusters, 199-203, 216-18, 465-67
 description of, 204
 evolution of, 41, 205-8
 in groups, 450
 low-surface-brightness, 449
Galaxies, S0 (lenticular)
 in clusters, 185, 187, 201-3, 213, 217, 446, 461, 466, 468
 description of, 203-4
 evolution of, 205-7, 446, 450, 465-66, 468
Galaxy, 7, 64
 cosmic rays in, 425-31, 439-41
 halo of, 427, 436, 440
 magnetic field in, 18-19, 439-40
Gamma-ray bursts, 585
Gamma-ray observations, 359-87
 solar, 283-84
 of SS 433, 522-24
Gamma-ray source at galactic center, 260-61
Gamma-ray spectra of solar flares, 283-84, 360-70
Gamma Ray Spectrometer, 360-67, 377-78, 381-84
Gamma rays
 production of, 475-77, 493, 499-500
Gamma rays, solar, 283-84, 359-84
 comparison with other flare emissions, 363-64
 duration of events, 364-66
GD 356, 31-32
GD 358, 32
General Relativity
 and black holes, 481-85
 tests of, 564, 575-79
Globular clusters
 in galaxies, 198, 210
 giants in, 20
 in irregular galaxies, 53
 in Magellanic Clouds, 53
Grand unified theories, 26, 157, 162, 166-67
Gravitation theory, 575-79
 alternative theories of, 158, 167-69
GX 301-2, 551
G109.9-1.0, 90
G292.0+1.8, 79-80

H

H₂ distribution near galactic center, 248-52, 262
H₂ emission regions, 304, 306-9
H I content. See also Twenty-one centimeter radiation of clusters of galaxies, 455-68 of galaxies in clusters, 205, 455-61 of groups of galaxies, 450-54, 467 of isolated galaxies, 455-56 of normal galaxies, 447-50
H I-deficient galaxies, 417, 455-61, 465-68
H I distribution
 in irregular galaxies, 41, 45-46, 55, 59-60, 65 in Sagittarius A complex, 233, 236-41, 262
H I emission in old supernova remnants, 89
H II regions, 7, 9, 13
 Fourier transform spectroscopy copy of, 304-7
 near galactic center, 250-53, 255-56
 intergalactic, 38, 41, 44-45, 47
 in irregular galaxies, 50-58, 63-65
 in Sagittarius A region, 224-26
 and supernova remnant, 79
Hakucho satellite, 540, 551
HEAO-1 observations, 81, 85, 522, 552
Helioseismology, 153, 593-619.
 See also Sun, oscillations of
Hercules cluster of galaxies, 193, 201, 207-8, 456, 466
Hercules X-1, 515-16, 528, 543, 547, 552, 559-64
Hinotori satellite, 360, 366-67, 382
HR 8752, 312
Hubble constant, 446-47
Hydra cluster of galaxies, 198, 456
HZ Herculis, 559-64
HZ 43, 28

I

Iapetus, 397
IC 10, 59
IC 443, 89
IC 1613, 58
IC 2082, 197
Infrared emission in Sagittarius A, 225-26, 230-31, 240, 243, 249
Infrared observations
 of radio jets, 341
 of Sagittarius A, 250-53
 of SS 433, 510-19
Infrared observations, far-, 246-49
Infrared photometry of irregular galaxies, 42
Infrared sources near galactic center, 246-63
Infrared spectroscopy, 292, 299-304, 309-14
Initial Mass Function, 41, 51-52, 54, 58-60, 62
Interferometry. See also Fourier transform spectroscopy
 infrared, 126
 optical, 126
 radio, see Radio interferometry
Intergalactic gas, 185-86, 451
Intergalactic medium, 352, 435-36, 446
Interstellar gas in galaxies, 445-70
Interstellar matter, 38
Interstellar medium, 64, 464
 in irregular galaxies, 333, 340-42
 shock waves in, 75-88
 and star-forming complexes, 56-58

and supernova remnants, 75–88

Interstellar polarization, 18, 34

Interstellar reddening, 4–6, 9

Intrachuster medium, 189–90, 192, 208, 464, 466–67

Io, 396

IRAS, 33

IRC+10216, 310–12

IRC+10420, 312

Irregular galaxies, *see* Galaxies, irregular

IRS 1, 256

IRS 7, 312

IRS 16, 236, 246–49, 257–60, 263, 312

IUE observations, 28, 51, 53, 83, 87–88

J

Jets in active galactic nuclei, 494–97

Jets, extragalactic radio, 319–58

collimation of, 336–41, 352–53

in core-dominated sources, 335–36, 350–51

curvature of, 335–36

defined, 320–21

expansion rates of, 337–41

infrared emission of, 341

instabilities in, 349–50

in lobe-dominated sources, 335, 350

magnetic fields in, 334–36, 339–42, 351–52

misalignments of, 335–36

at optical and infrared wavelengths, 341–42

polarization in, 334–35, 341, 353

in powerful radio galaxies, 337–38, 350–52

radio spectra of, 339

relativistic, 348, 351

sidedness of, 333–35, 346–49, 351–53

sizes of, 335

sources of, 321–33

unified models for, 350–52

velocity estimates of, 343–48

in weak radio galaxies, 332–36, 350–51

X-ray emission from, 337–38, 342

in X-ray haloes, 337

Jets in SS 433, 333, 494, 508–9, 521–30

Jupiter

atmosphere of, 301, 393–95

composition of, 390–95

evolution of, 406–11

excess luminosity of, 409–11, 422

formation of, 405, 421

Fourier transform spectra of, 301–3

magnetic field of, 395

rings of, 397

satellites of, 396, 414–15, 419–20

K

Kepler's supernova remnant, 82

L

Lambda Andromeda, 299

Large Magellanic Cloud

irregular galaxies in, 37–38, 43, 45–49, 51–53, 58

supernova remnants in, 79–82, 84, 90–91

Leo triplet of galaxies, 451–54

Light, alternative theories of, 164–65

LMC X-4, 549–52, 554, 562–63

Local Group, 41, 451

Local supercluster, 439

Lorentz factor, 508, 512

LSG 3, 41

M

Magellanic Clouds, 38, 52–53, 55, 57–58, 61, 90–91, 451, 531. *See also* Large Magellanic Cloud and Small Magellanic Cloud

Magellanic Stream, 451

Magnetic field in Galaxy, 18

Magnetic fields, 34, 55, 299

and black holes, 474, 483–85, 487, 493

in neutron stars, 436–37, 540, 571–74, 579, 585

of outer planets, 395

in radio jets, 334–36, 339–42, 351–52

solar, 131, 134, 136–39, 148–50, 152–53, 267–69, 277–78, 281–83, 286–87, 299

Markarian galaxies, 61

Mars, 300–1, 398, 405, 421

Masers, 109–10

Mass-loss from evolved stars, 309–12

MERLIN, 98, 114, 126

Milky Way, 13, 53–54, 451.

See also Galaxy

Minkowski space-time, 171–73, 181

Mira variables, 299

Model atmospheres, 14

Molecular clouds, 6, 57–58, 333

Fourier transform spectroscopy of, 304–7, 333

near galactic center, 229–45, 261–62

Monogem ring, 90

MSH 15–52, 90

MXB 1730–335, 582–83

M 3, 5

M 31, 9, 64, 91, 451, 531

M 33, 91, 451

M 51, 454

M 81, 313, 451

M 82, 47, 57, 61, 313, 451, 454

M 84, 339, 347

M 86, 460

M 87, 198, 319, 337, 340–42, 460–61, 495

N

Nebular spectrograph, 8–9

Neptune

atmosphere of, 395

composition of, 390–95

evolution of, 406, 412–13

excess luminosity of, 412–13, 422

satellites of, 396–97, 412, 414, 419

Neutron star in SS 433, 529–30

Neutron stars, 537–92

accretion in, 540, 545–52, 568–75, 579, 582–86

in binary X-ray pulsars, 538–64

as cosmic-ray source, 436

cyclotron radiation from, 543–47

magnetic fields in, 436–37, 540, 571–74, 579, 585

masses of, 562–64, 573, 575–79, 581, 586

radii of, 573, 575–79, 581

in X-ray burst sources, 564–68

thermonuclear flash model for, 568–86

NGC 206, 64

NGC 253, 313

NGC 315, 336–37

NGC 604, 51

NGC 612, 347

NGC 628, 450

NGC 678/680, 454

NGC 1068, 313–14

NGC 1275, 118

NGC 1316, 188–89, 195–96

NGC 1510/1512, 454

NGC 1569, 46, 54, 62

NGC 1705, 61

NGC 2257, 53
 NGC 3077, 451, 454
 NGC 3311, 198
 NGC 3607, 451
 NGC 3623/3627/3628, 451-54
 NGC 3665, 347
 NGC 4026, 454
 NGC 4038/4039, 451
 NGC 4151, 313
 NGC 4214, 41
 NGC 4449, 39, 41, 79
 NGC 4472, 461
 NGC 4631/4656, 451
 NGC 4676, 452
 NGC 4747, 452, 454
 NGC 5253, 56, 61
 NGC 5846, 451
 NGC 6041a, b, 193
 NGC 6166, 193, 201
 NGC 6251, 320, 336-37, 340
 NGC 6822, 63
 NGC 7252, 209
 NGC 7720, 193
 North Polar Spur, 89-90
 N132D, 79
 N157B, 84

O

O stars, 4, 27-28
 OAO observations, 41
 OB associations, 38, 53, 62
 OB star formation, 38, 41, 52, 61
 OB stars, 41, 42, 51-53, 61-62, 65
 OI 287, 499
 Optically violent variables, 495, 499
 Optics design, 12
 Orion molecular cloud, 305-7
 BN source in, 305

P

Pair production, 474-76, 484, 499-500, 502
 Pegasus cluster of galaxies, 459
 Phoebe, 414
 Photoclectric photometry, 6, 8-9, 15
 Plaques, 131, 150-52
 Planets. See also individual planets
 atmospheres of, 301, 393-95, 405
 Fourier transform spectra of, 300-3
 Planets, outer
 abundances in, 301, 393-95
 composition of, 390-95
 evolution of, 406-13

excess luminosity of, 390, 409-13, 422
 origin of, 398-406
 core instability model for, 401-8, 416, 421
 gas instability model for, 401-8, 421
 rings of, 416-22
 satellites of, 395-97, 414-23
 origin of irregular, 414-16, 423
 origin of regular, 416-23

Planets, terrestrial, 389

Polarization

in Crab nebula, 84
 interstellar, 18, 34
 in radio jets, 334-35, 341, 353
 in Tycho's supernova remnant, 81
 PSR 1913+16, 563
 Pulsars, 21, 484
 particle acceleration in, 432, 436-38, 440
 Pulsars, binary X-ray, 538-64, 585-86
 accretion in, 538, 543-52, 586
 distribution of, 538, 566
 masses of companion stars in, 559-61
 neutron stars in, 540-64
 orbital determinations of, 552-62
 pulse-period variations in, 547-52
 pulse profiles of, 540-43, 546-47
 radii of companion stars in, 559-61
 spectra of, 543-47
 Pulsars, radio, 337-39, 563-64
 Puppis A, 90

Q

Quarks, 537n, 564
 Quasars, 21-22, 27, 34, 113, 118, 494, 499-502
 jets in, see Jets, extragalactic radio

Quasi-stationary flocculi, 76-79
 Quasi-stellar objects, 157, 165, 175, 319, 350, 498-500

R

Radio astronomy, 7, 13, 33
 self-calibration techniques used in, 97-130. See also
 Radio interferometers, Radio interferometry

Radio emission
 from galactic center, 250-57, 261-62
 from Sagittarius A region, 224-41
 solar, 267, 276, 279-81, 283-85, 383

Radio galaxies, 319-58, 499
 cosmic rays from, 435, 437
 evolution of, 494, 500-1
 fast-moving knots in, 436
 jets in, see Jets, extragalactic radio

Radio interferometers

calibration of, 97-130
 theory of, 98-101
 Radio interferometry
 aperture synthesis in, see Aperture synthesis
 calibration of arrays, 97-130
 hybrid mapping, 98, 104, 110-20, 125
 maximum entropy methods, 114-17
 redundancy in, 117-18
 closure amplitudes in, 98, 100-4, 112-14, 121-24
 closure phases in, 98, 100-4, 112-14, 120-27

Radio observations of supernova remnants, 77, 79, 81-82, 84-85

Radio pulsars, 538-39, 563-64

Radio sources
 jets in, see Jets, extragalactic radio

Sagittarius A*, 223-64

SS 433, 507-36

symmetries of, 348-49

Ram pressure, 464, 466-67

Redshift

alternative views of, 164-65
 in clusters of galaxies, 214-16, 461

cosmological, 158-59, 177

in galaxies, 157, 165

local Doppler, 158-59

local gravitational, 158-59

in QSOs, 157, 165

Relativistic particles, 425-27, 497

RR Lyrae variables, 5

S

S stars, 19, 310

Sagittarius A, 223-265

H I in, 233, 236-41, 262
 H II regions in, 224-26, 230, 234

infrared emission in, 225-26, 230-31, 240, 243

ionized gas in, 224–26, 229–41
 molecular cloud in, 229–36, 242–45, 262
 radio emission from, 224–41
 radio spur in, 224, 229, 231
 X-ray emission from, 226–28

Sagittarius A*, 224–25, 235–41, 257–60, 263

Sagittarius A East, 224, 235–36

Sagittarius A West, 224, 227, 233, 235–36, 250, 333

SAS-3 satellite, 540

Saturn
 atmosphere of, 301, 390, 393–95
 composition of, 391–95
 evolution of 406–12
 excess luminosity of, 409–12, 422
 Fourier transform spectra of, 301–3
 magnetic field of, 395
 rings of, 397, 419–21
 satellites of, 396–97, 414–15, 419

Self-calibration techniques in infrared interferometers, 126
 in optical astronomy, 126–27
 in radio astronomy, 97–130

Seyfert galaxies, 217, 313, 332–33, 502

Shock waves
 interplanetary, 284–85
 in interstellar medium, 75–88
 particle acceleration by, 433, 435–36, 438
 solar, 273–75, 280, 283–84
 in supernova remnants, 75–88, 436

Skylab observations, 152, 268–69, 273–85

Small Magellanic Cloud, 37, 49, 51, 80

SMC X-1, 553–54, 559, 562

SN 1006, 82

SN 1592, 80–82

Solar activity cycle, 145–46

Solar corona
 mass ejections from, 267–89
 aftermath of, 277–78
 development of, 269–71
 flare-associated, 268, 272–74, 276, 278–79, 281, 283, 286–87
 frequency of, 273–74
 and high-temperature emission phenomena, 279–80
 mass forerunners of, 275
 models for, 268–69
 outriding pressure pulses of, 275–76

plasmoids in, 269, 271, 281, 285
 precursors of, 276–77, 286
 and prominences, 267–68, 272–73, 276, 278–79, 281, 285–87
 shapes of, 269, 271–72, 286
 unassociated, 271, 281–83, 286–87
 rotation of, 150–52

Solar cosmic rays, 359n

Solar energetic particles, 359–87

Solar faculae, 150

Solar flares
 and coronal mass ejections, 267, 272–76, 278–79, 283, 285–87
 electron and ion acceleration in, 368–84
 gamma-ray observations of, 283–84
 gamma-ray spectra of, 360–70
 particle acceleration in, 359–87

Solar gamma-ray spectra
 delayed, 367–70, 373
 prompt, 366–70, 372–73, 377–78, 381

Solar interior
 rotation of, 152–53
 structure of, 593–619

Solar limb
 oscillations of, 601–2, 611–12
 polarization in, 300
 red shift, 132–34

Solar limb darkening, 14

Solar Maximum Mission, 268–69, 274–75, 278, 283, 360–70, 377, 381, 601, 608–9

Solar meridional flow, 133–34

Solar model, standard, 594–600, 604, 609–10, 613

Solar nebula, 393, 396, 415, 423
 accretion in 398–99, 401–5, 419, 421

Solar neutrons, 360–61, 368–70, 380–81
 at Earth's surface, 376
 interaction with photosphere, 375
 theoretical models for, 370, 374–76

Solar radio bursts
 type II, 274, 280–81, 283–84, 383
 type III, 276
 type IV, 280–81, 284–85

Solar rotation, 131–55, 612
 depth dependence of, 142–43
 differential, 135–39
 rate of equatorial, 134–35
 surface, 131–43

Solar system
 abundances in, 301
 Fourier transform spectroscopy of, 300–1

Solar wind, 267–68, 275, 284–85

Solwind observations, 268–69, 271–72, 275, 283

Spectroscopy, Fourier transform, see Fourier transform spectroscopy

Standard Hot Big Bang Theory of Universe, 157–84

SS 433, 507–36
 accretion disk in, 509, 513–19, 526–29
 compact star in, 509, 518, 529–30
 distance of, 509–10, 522
 Doppler-shifted lines in, 507–16
 gamma-ray observations of, 522–24
 infrared observations of, 510–19
 interstellar extinction of, 515, 517–18
 jets in, 333, 494, 508–9, 513–14, 518, 521–30
 kinematic model of, 508–9, 511–13
 deviations from, 513–15
 luminosity of, 518, 526
 optical photometry of, 518–19
 optical spectrum of, 507–8, 510–19
 polarization in, 518
 radial velocity variations in, 509, 516–17
 radio observations of, 507, 519–22
 radio source in, 509–10, 520, 524
 stationary spectrum of, 515–17
 variability of, 508–15, 518–20, 523–24

X-ray observations of, 507, 509–10, 517, 520, 522–24, 529

Star clusters, 52–53, 62

Star formation, 38–67, 186–87, 194, 205–7, 211, 217, 229, 263, 304–9, 446, 454, 464–65

Stars
 abundances in, 10, 14, 19–20, 298
 Am, 14
 Asymptotic giant branch, 42, 52
 B-type, see B stars
 colors of, 4
 convection in, 299

coronal mass ejections from, 285
 F-type, supergiant, 312
 G-type, 20
 giant, 299
 heavy-element, 19
 intermediate mass, 52
 magnetic fields in, 299
 mass-loss from evolved, 309–12
 oscillations of, 615–16
 red degenerate, 30–31
 S-type, 19, 310
 subluminous, 27
 Static universe, 180
 Steady-state universe, 180
 Stellar rotation, 299
 Stellar wind, 304, 550–51, 567
 Stochastic self-propagating star formation model, 63–64, 66
 Sun
 abundance analyses of, 298–99
 atmosphere of, 359–87
 chromosphere of, rotation of, 142–43, 150–52
 convection in, 299
 convection zone of, 136–37, 593–619
 corona of, see Solar corona
 differential rotation of, 135–39
 Fourier transform spectra of, 297–99
 gamma-ray observations of, 283–84, 359–87
 infrared spectrum of, 299
 magnetic fields in, 131, 267–69, 277–78, 281–83, 286–87, 299
 rotation of, 134, 136, 138–39, 148–50, 152–53
 in old supernova remnant, 89
 oscillations of, 593–619
 acoustic modes of, 595–600, 602–3, 606–10, 614–15
 chromospheric modes of, 600, 602
 classification of, 615–16
 five-minute, 593, 602, 605–8, 610–11, 614
 f-modes of, 599, 602, 615
 gravity modes of, 593–600, 602, 609, 614–16
 normal mode of, 594–96
 observational techniques for discovering, 600–2
 160-minute, 593, 606, 614
 photosphere of
 neutron interaction with, 375–76
 rotation of, 134–36, 142–43, 145–47, 151–52

rotation of magnetic fields in, 148–50
 plages in, 150, 152
 primordial helium abundance in, 610
 prominences in, and coronal mass ejections, 267, 272–73, 276, 278–79, 285–87
 radio observations of, 267, 276, 279–81, 283–85, 383
 resonant cavities in, 594–600
 rotation of, see Solar rotation
 torsional oscillations of, 139–42, 146, 153
 ultraviolet spectrum of, 13
 X-ray emission from, 276–77, 279–80, 283–84, 364, 374, 381–82
 Sunspots, 360
 rotation of, 131, 134–37, 141
 rates of, 143–50
 Supernova remnants, 75–95, 507, 524–26, 531
 abundances in, 76–91
 Cassiopeia A, 76–79
 Crab nebula, 83–84
 Cygnus Loop, 84–89
 fast-moving knot in, 76–79
 and interstellar medium, 75–89
 metal-rich, 76–80
 middle-aged, 84–89
 in Magellanic Clouds, 79–82, 84, 90–91
 in M 31 and M 33, 91
 the North Polar Spur, 89–90
 old, 89–90
 quasi-stationary flocculi in, 76–77, 79
 radio observations of, 77, 79, 81, 84, 85, 89–90
 shock waves in, 75–88
 transitional, 90
 Type I, 75, 80–84
 Type II, 75–80
 ultraviolet observations of, 83, 87–89
 X-ray observations of, 76–90
 young, 76–84
 21-cm observations of 81, 85, 89
 Supernovae and shock-wave production, 436, 438, 441

T

Technetium, 19
 Titan, 302, 397, 419–20
 Tololo 3, 52
 Tonantzinia 202, 27
 Triton, 397, 412, 419

Twenty-one centimeter observations, 42–43, 81, 85, 89, 531. See also H I content
 Tycho's supernova remnant, 80–82

U

Uhuru satellite, 538
 Ultraviolet observations, 28, 51, 53, 83, 87–89
 Universe
 alternatives to big bang theory of, 157–84
 anisotropic models for, 169–74
 orthogonal, 170–71
 tilted, 171–74
 big bang theory of origin of, 157–84
 energy conditions of matter in, 159–67
 Friedmann–Lemaître–Robertson–Walker (FLRW) model for, 157–59, 161–69, 180
 inhomogeneous models for, 174–80
 initial singularity of, 157, 161–81
 timelike, 175–77, 180
 standard models for, 157–62
 static theory of, 180
 steady-state theory of, 157, 180

Upsilon Sagittarii, 10
 Uranus
 atmosphere of, 395
 composition of, 390–95
 evolution of, 406, 412–13
 excess luminosity of, 412–13, 422
 rings of, 397
 satellites of, 397, 419

V

V 1343 Aquilae, see SS 433
 Vela supernova remnant, 90
 Venus, 300
 Virgo cluster of galaxies, 186–87, 200
 as cosmic-ray source, 427, 435, 441
 H I content of, 447–48, 456, 460–63, 465–67
 Virgo supercluster, 432, 439
 VLA, 26, 33, 97–98, 101, 113–14, 123–24, 126
 VLA observations
 of galactic center region, 241, 250, 252
 of Sagittarius A region, 235–36

of SS 433, 519-21
of Virgo cluster, 461

VLBI observations
of jets, 494-95
of radio sources, 320,
323, 336, 347-48,
352

of SS 433, 519-21

VLBI, self-calibration techniques
used in, 97-98, 100-4,
109-10, 113, 117-21, 124-
27

use of global fringe-fitting in,
118-20

Voyager observations, 87, 303,
393, 411

W

Westerbork Synthesis Radio
Telescope (WSRT), 97-98,
118, 126, 235, 461

White dwarfs, 20, 27-32

Wolf-Rayet stars, 52

W 50, 90, 507, 514, 518, 522-
26

XYZ

XB 1745-24, 581-82

X-ray binaries, see Pulsars, X-
ray binary

X-ray burst sources, 538, 540,
564-86

ages of, 585-86

as binary stellar systems, 566-
68

distribution of, 564-66, 586

neutron stars in, 538, 540,
566-86

optical counterparts of, 566-
68

spectra of, 564-66, 575

thermonuclear flashes in, 568-
85

X-ray emission, 34

in active galactic nuclei, 499-
500

in galaxies, 191-92, 450-51,
464, 466

in Sagittarius A complex,
226-28

from sun, 276-77, 279-80,
283-84, 364, 374, 381-
82

X-ray observations,
of radio jets, 337-38, 342

of SS 433, 507, 509-10, 517,
520, 522-24, 529

of supernova remnants, 76-90

of X-ray pulsars, 546-47

X-ray pulsars, binary, see Pul-
sars, binary X-ray

X-ray sources, 193

active galactic nuclei as, 499-
500

in irregular galaxies, 41

radio jets as, 337-38, 342

SS 433 as, 507-36

supernova remnants as, 76-90

X-ray transients, fast, 583-85

Z 74-23, 459

ZZ Ceti variables, 30-31

ZZ Ceti white dwarf, 32

MISCELLANEOUS

1E0102.2-7219, 80

2S1417-62, 549

3C 31, 321, 341

3C 33.1, 337

3C 48, 21-22

3C 58, 84

3C 66B, 337, 341

3C 111, 337

3C 147, 113

3C 200, 332

3C 219, 337

3C 273, 21-22, 320, 341-42,
504

3C 277.3, 341

3C 295, 213-14, 216-18

3C 341, 332, 339

3C 345, 118, 320

4C 04.66, 520

4C 32.69, 339

4U0115+63, 543, 549

4U0900-40, 551-52, 554, 558-
59, 562

4U1145-61, 549

4U1538-52, 554, 559, 562

4U1626-67, 549, 561-62, 566

4U1915-05, 567

0540-69.3, 80

0957+561, 109

1321+31, 339

2354+47, 337

I Zw 18, 47, 49

VII Zw 403, 41, 51

